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Applicant YAMAOKA, Yukio et al	

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18 September 2000 (18.09.00)

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR 00/00151

A. CLASSIFICATION OF SUBJECT MATTER

IPC[7]: B 23 K 9/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC[7]: B 23 K 9/12, 9/24, 9/26

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3799215 A (WILLEMS) 26 March 1974 (26.03.74), fig. 1,2.	1,2
A	AT 167656 B (ELIN) 15 July 1950 (15.07.50), fig..	1,2

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
02 May 2000 (02.05.00)	19 July 2000 (19.07.00)
Name and mailing adress of the ISA/AT Austrian Patent Office Kohlmarkt 8-10; A-1014 Vienna Facsimile No. 1/53424/200	Authorized officer Bencze Telephone No. 1/53424/373

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report			Publication date	Patent family member(s)			Publication date
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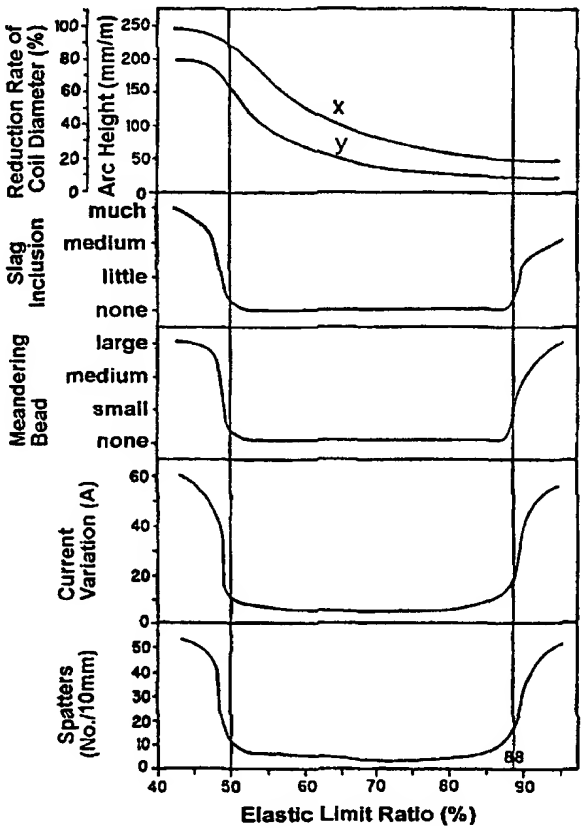
(54) Title: WELDING SOLID WIRE WITH HIGH FEEDING PERFORMANCE

(57) Abstract

The invention an arc welding solid wire whose surface comprises copper plated film, wherein the elastic limit ratio (elastic limit/tensile strength) of the wire finally produced is controlled in the range between 50 and 88 % by installing three to eight elastic limit ratio control vertical rollers and three to eight elastic limit ratio control transverse rollers which have a ratio D/d equal to 40 to 60, following coil control vertical and transverse rollers after final drawing.



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WELDING SOLID WIRE WITH HIGH FEEDING PERFORMANCE

BACKGROUND OF THE INVENTION

Field of the invention

The present invention relates to a welding solid wire with high feeding performance and arc stability on welding.

Description of the Related Art

Generally, from the viewpoint of improving the quality of a welded bead portion, arc stability on welding is important in a welding wire without regard to the kind of wire such as a solid wire, a flux cored wire or the like. Also, it is generally recognized that arc stability is closely related to feeding performance of the wire.

For example, Japanese Patent Laid-open Publication No. (Sho) 56-144892 discloses a solid wire plated with copper, which improves feeding performance by means of fluid lubricant retained within grooves which are formed on the surface of the wire, and by wet wire drawing work with grain boundary oxidation. Also, Japanese Patent Laid-open Publication No. (Hei) 5-1120 describes that arc stability of a wire may be obtained by performing wet wire drawing work of over one pass prior to plating work and improving adhesive performance of plating by cleaning the wire surface.

It has also been disclosed that improving the properties of lubricant used in wire drawing work stabilizes the feeding performance so that arc stability is improved.

Lately, for solid wires and flux cored wires, Japanese Patent Publication Nos. (Hei) 2-682806 and (Hei) 2-731505 disclose that arc stability is improved by forcing a reduction in the ratio of an apparent surface area calculated from the ratio of the substantial surface area to wire diameter.

It has also been disclosed in Japanese Patent Publication Nos. (Hei) 2-723793 and (Hei) 2-723799 that arc stability is improved by reducing impurities of over 0.2 ㎛ in diameter which adhere to and remain on a wire surface.

The prior art described above relate to properties and conditions of a wire surface.

First, the problems in feeding systems for wires will be considered.

Figs. 1A and 1B show the feeding system for a copper plated solid welding wire, and particularly Fig. 1A and Fig. 1B represent systems using a wire reel and a pail pack, respectively.

A wire 6 is fed from a wire reel 1 or a pail pack 10 into feeding rollers 2 or 9. Then, before feeding to a tip portion 5 of a welding zone, the wire 6 in the wire reel 1 is fed through a guide tool 3 and a cable 4 and the wire 6 in the pail pack 10 is directly fed through the cable 4. Most of cable 4 has a bent portion X or Y and wire 6 contacts with the inner wall of the cable 4, resulting in large resistance which decreases the feeding performance. In addition, the reference numeral 7 in drawings indicates an arc forming a bead between weld zone and the end portion of the wire 6, and the reference numeral 8 indicates a power source.

In addition, referring to Fig. 2 which is a sectional view of the welding tip portion 5, the wire 6 is subjected to large resistance at contact points A, B and C of the inner wall of the tip portion, which affects the feeding performance of the wire.

In the case as described above, it is natural that the change of the properties of the wire surface should affect the feeding performance, i.e. stability of the arc 7 at the end portion of the fed wire 6. However, it is not clear whether the properties of the wire surface relate to the feeding performance. Thus, the matters noted above have required close examination.

As high efficiency for welding has been required lately and the feeding speed of wires tends to increase, higher arc stability is also required, but technical developments for arc stability have not progressed accordingly.

SUMMARY OF THE INVENTION

The present invention addresses the matters discussed above. It is an object of the present invention to provide a solid welding wire which has high arc stability by stabilizing the feeding performance of the wire upon welding.

It is another object of the present invention to provide a solid welding wire whose surface comprises copper plated film and which has high arc stability and high feeding performance upon welding

These and other objects will become apparent to one skilled in the art after having the benefit of the following disclosure.

The present invention is directed to an arc welding solid wire whose surface comprises copper plated film, wherein the elastic limit ratio of the finally produced wire is controlled in the range between 50 and 88 %. The elastic limit ratio is defined

as the ratio between elastic limit and tensile strength.

The elastic limit ratio is controlled by installing three to eight elastic limit ratio control vertical rollers and three to eight elastic limit ratio control transverse rollers. The elastic limit ratio control vertical and transverse rollers have a ratio D/d of 40 to 60, where "D" is roller diameter and "d" is wire diameter, and follow the coil control vertical and transverse rollers after final drawing of the welding solid wire whose surface comprises copper plated film.

BRIEF DESCRIPTION OF THE DRAWINGS

Figs. 1A and 1B depict feeding systems for a solid welding wire.

Fig. 2 is a cross-sectional view of a welding tip portion.

Fig. 3 is a group of graphs showing relationship between coil properties and the elastic limit ratio and between welding performances and the elastic limit ratio.

Fig. 4 illustrates an arc height that is generated by cutting a wire with a 1-meter chord.

Fig. 5 is a graph showing relationship between stress and elongation ratio of a wire for achieving the elastic limit ratio.

Fig. 6 depicts a conventional coil control vertical and transverse rollers.

Fig. 7 illustrates the elastic limit ratio control rollers of the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

To achieve the objects of the invention, wire feeding performance was closely examined from a new point of view. The subject matter of the examination was a solid welding wire which had a small change in surface properties as wet wire drawing work is performed after copper plating. The feeding path such as shown in Figs. 1 and 2, and the relationships between the mechanical properties and the feeding performances of the wire itself were also carefully researched. As a result, it was newly discovered that the wire feeding performance is closely related to the mechanical properties of the wire.

That is, the coil properties of a solid wire which is set free after extraction from the reel or the pail pack were compared with the coil properties when the coil is cut after the solid wire is freely fed from the welding tip portion with the welding stopped. From this, it was discovered that wire extracted from the welding tip portion wherein the coil properties are in the specific predetermined range, has good stability

and can be used in welding with good bead. Thus, the present invention is achieved by the discovery that the good stability is closely related to the elastic limit ratio (elastic limit : tensile strength) of the wire.

That is, the invention relates to a solid welding wire whose surface comprises copper plated film and wherein the ratio between the elastic limit and tensile strength, the elastic limit ratio, is controlled to be in the range between 50 and 88 %, which will be described in the following.

Fig. 3 is a group of graphs showing relationship between coil properties and the elastic limit ratio and between welding performances and the elastic limit ratio. The measurements of arc height x (㎜/m), reduction rate of a coil diameter y(%), the existence of slag inclusion, the state of meandering beads, a variation of current on welding A, the number of spatters of over 1 ㎜ in diameter (number/10 ㎝) and the elastic limit ratio shown in Fig. 3 are described as follows.

1) The arc height x (㎜/m):

After extraction from the pail pack, the solid wire is wound four times around a cylinder of 100 ㎜ in diameter and held for 30 seconds. Then, when it is set free, its arc height is the height of the arc made by cutting the wire into a chord of 1 m.

2) The reduction rate of a coil diameter y(%):

After set free from the reel, the diameter of the coil is measured. The wire is then wound twice around a cylinder of 100 ㎜ in diameter and held for 30 seconds. The difference between the coil diameter after it is set free again and the coil diameter before being wound around the cylinder is measured. Thus, the reduction rate of the coil diameter is calculated from the difference in the two coil diameters.

3) The existence of slag inclusion, amount of meandering bead, the variation of current on welding and the number of spatters of over 1 ㎜ in diameter:

These are found with performed by flat position welding.

4) The elastic limit ratio

After a stress-elongation ratio graph is plotted from tensile tests of the solid wire, the elastic limit ratio is derived from the elastic limit as the stress that corresponds to the permanent elongation ratio of 0.05 % in Fig. 5.

For example, Fig. 5 shows the case of the elastic limit ratio (elastic limit/tensile strength) at 102/125 which is 81.6 %.

As shown by the graphs in Fig. 3, solid wire is easily bent and there is a large change in the linearity of the wire or the diameter of free coil in proportion to the decrease in the elastic limit ratio. This disclosure shows for the first time that, contrary to such a tendency, welding performance is good when the elastic limit ratio

is between 50 and 88 %.

Therefore, in view of the results examined from the tendency, the following facts become clear.

If the elastic limit ratio is low and as the wire is easily bent, both the wire 6 wound around reel 1 with large coil diameter and the almost straight flat wire 6 in pail pack 10 are easily bent and deformed at the cable bending portion X or Y shown in Fig. 1 or at other cable bending portions with large curvature. Thus, the resistance between the wire 6 and the inner wall of the cable 4 is small since wire 6 follows the bent cable 4 easily. However, since the inside of the tip portion 5 shown in Fig. 2 as the final outlet of the wire is a fully straight hole, the bent wire is subjected to large resistance. As a result, the feeding performance of the wire deteriorates so that welding quality becomes poor.

If the elastic limit ratio is high, there is no problem for feeding at tip portion 5 having the straight hole as shown in Fig. 2. However, since the wire has a small change of linearity and deformation in the coil, the wire is not easily bent at the cable bending portion (X or Y) and has large spring-back force, so that the wire is subject to large resistance. Thus, the wire fed from the feeding rollers does not run smoothly so that the arc becomes unstable, and then the welding quality deteriorates as in the case of wire with low elastic limit ratio.

Therefore, when the elastic limit ratio is in the range between 50 and 88 % which is neither low nor high as a compromise between these tendencies, wire is fed without large resistance at both the cable bending portion (X or Y) and the tip portion so that the arc is stabilized and welding quality is improved. That is, it is the feature of the present invention to avoid the condition wherein wire is subjected to large resistance between the wire source and the welding zone.

In accordance with the present disclosure, the relationship between arc stability and coil properties when feeding the wire automatically from the tip portion with the welding stopped, shows that the wire has a good arc stability as described above only in the specific predetermined range of coil properties.

The technology for maintaining the elastic limit ratio in the range between 50 and 88 % is not limited to the examples herein and one skilled in the art will find variations after having the benefit of the present disclosure.

Generally, in manufacturing a copper plated solid wire, the coil is controlled with coil control vertical and transverse rollers immediately after wet drawing work. As shown in Fig. 6, the wire is pressed upward, downward, leftward, and rightward by these rollers (D/d is 20, where D is roller diameter and d is wire diameter)

comprising eight to twelve vertical rollers 14 and eight to twelve transverse rollers 15. Then, the wire is wound in the pail pack or around the reel. However, if strong pressure is exerted on wire 6, portions of it get wound with short frequency (fine wound deformation) which causes unstable arcs. Fine wound deformation is due to insufficiency of the vertical and transverse rollers alone for coil bending work to control the elastic limit ratio in the range of 50 to 88 %. Thus, the object of the present invention cannot be achieved with only the vertical and transverse rollers as unstable arcs occur.

Therefore, to control the stability of the elastic limit ratio without fine wound deformation in the wire, elastic limit ratio control rollers with a ratio D/d of 40 to 60 (again where D is roller diameter and d is wire diameter) as shown in Fig. 7 are necessary immediately following the vertical and transverse rollers as shown in Fig. 6. Fig. 7 shows five U-shaped hang-on rollers on which a wire is hung in the shape of a U and the wire 6 from a pair of guide rollers 11, passes through five bending rollers 12 as the vertical rollers and is drawn out of a pair of guide rollers 13. The transverse rollers which have the same configuration as the vertical ones are mounted in subsequence. In this configuration, it is possible to manufacture solid wire with no fine wound deformation that is stable in the desired elastic limit ratio. Contrary to the arrangement in Fig. 6, the U-shaped hang-on rollers as shown in Fig. 7 are required for a running path for the wire.

Referring to a following example, a preferred embodiment of the invention will be explained.

Subjected to pickling and borax coating, a rod of 5.5 ㎜ in diameter which contains 0.06 % C, 0.9 % Si, 1.5 % Mn, 0.015 % P, 0.01 % S, and 0.11 % Ti, is drawn up to 2.2 ㎜ in diameter, and then annealed at about 700 ℃. After electrolytic-pickling (with sulfuric acid), water-cleaned, and treated with cyanic copper plating (plated copper of 3 g/kg Fe), the rod is finished as a welding solid wire of 1.2 ㎜ in diameter at the rate of 400 m/min by drawing seven times with water-soluble lubricant used in a drawing machine. Two types of coils which are wound around a smaller reel of 20 kg after around a larger reel and wound in a pail pack, are manufactured.

To vary the elastic limit ratio of the solid wire manufactured by using coil control rollers as shown in Fig. 6, the ratio D/d is altered to 10 to 80 using the U-shaped hang-on vertical and transverse rollers followed by installed control rollers as shown in Fig. 7, and by changing the number of the vertical and transverse U-shaped hang-on rollers.

A bead of 60 ㎝ is welded on fillet joint by flat position welding with the

following welding conditions, current of 300 A, voltage of 32 V, and shield CO_2 of 30 ℓ /min.

The properties of the solid wire itself are checked by changing the coil properties for the elastic limit ratio as shown in Fig. 3. Here, the elastic limit ratio is obtained from elastic limit/tensile strength, after plotting a graph for the stress-elongation ratio of Fig. 5 from the tensile test of the solid wire and determining the elastic limit from the stress corresponding to the permanent elongation ratio of 0.05 %.

To evaluate the arc stability, the variation of current on welding, the existence of slag inclusion, the number of spatters of over 1 ㎜ in diameter, and the state of meandering bead were all noted and recorded. The results are presented in the following Table 1.

As shown in Table 1, if the elastic limit ratio of the wire itself is controlled in the range between 50 and 88 %, it is clear that neither slag inclusion nor meandering bead occurs, resulting in decrease of current on welding and the number of spatters, so that a good welding bead can be achieved.

According to the solid welding wire with good feeding performance of the present invention described in the claims, feeding performance and arc stability are improved by controlling the elastic limit ratio (elastic limit/tensile strength) of the solid wire in the range between 50 and 88 % after final drawing in manufacturing copper plated, arc welding solid wire. Accordingly, good welding beads which have neither slag inclusion nor meandering beads, and have less spatter, can be easily achieved.

According to another variation in the invention described in the claims, three to eight elastic limit ratio control vertical rollers and three to eight elastic limit ratio control transverse rollers which have the ratio D/d of 40 to 60 are installed following coil control vertical and transverse rollers after final wire drawing work. In this arrangement, elastic limit ratio of solid wire can be easily controlled in the range between 50 and 88 %.

This disclosure is not intended to limit the present invention to the examples disclosed herein. Rather, one skilled in the art will appreciate that numerous variations are possible after studying this specification. All these variations are within the scope and spirit of the invention as claimed below.

Table 1

No.	Wire Diameter	Winding Type	Elastic Limit Ratio	Reduction Rate of Coil Diameter	Arc Height (mm/m)	Degree of Slag Inclusion	Degree of Meandering Bead	Current Variation (A)	Spatters (No./10mm)	D/d	U-shaped Hang-on Rrollers	Remarks
1	1.2	Reel	42.1	80.0	248	much	large	60	55	10	20	comparative
2			47.5	74.5	231	medium	large	48	46	35	18	comparative
3			50.0	60.0	225	none	none	10	8	40	16	present invention
4			60.1	25.0	120	none	none	7	5	48	14	present invention
5			75.2	11.0	70	none	none	6	3	50	12	present invention
6			85.4	9	50	none	none	9	8	55	10	present invention
7			88.0	9	48	none	none	15	17	60	6	present invention
8			91.2	9	50	medium	medium	49	45	65	4	comparative
9			95.0	10	50	medium	large	56	49	80	4	comparative
10			96.8	10	48	medium	large	60	52	-	0	comparative
11		Pail Pack	43.2	80.0	246	much	large	58	54	10	20	comparative
12			48.0	73.0	235	medium	large	49	48	35	18	comparative
13			50.0	59.4	220	none	none	11	7	40	16	present invention
14			61.2	24.8	125	none	none	7	5	48	14	present invention
15			76.6	11.2	72	none	none	6	3	50	12	present invention
16			86.1	8	48	none	none	8	8	55	10	present invention
17			88.0	9	47	none	none	16	16	60	6	present invention
18			92.0	9	50	medium	medium	50	45	65	4	comparative
19			94.8	10	50	medium	large	57	49	80	4	comparative
20			95.2	9	48	medium	large	58	49	-	0	comparative

What is claimed is:

1. An arc welding solid wire whose surface comprises copper plated film, wherein the elastic limit ratio (elastic limit/tensile strength) of the wire finally produced is controlled in the range between 50 and 88 %.

2. The arc welding solid wire of claim 1, wherein said elastic limit ratio is controlled by installing three to eight elastic limit ratio control vertical rollers and three to eight elastic limit ratio control transverse rollers which have a ratio D/d equal to 40 to 60 (where D is roller diameter and d is wire diameter) following coil control vertical and transverse rollers after final drawing.

Fig. 1A

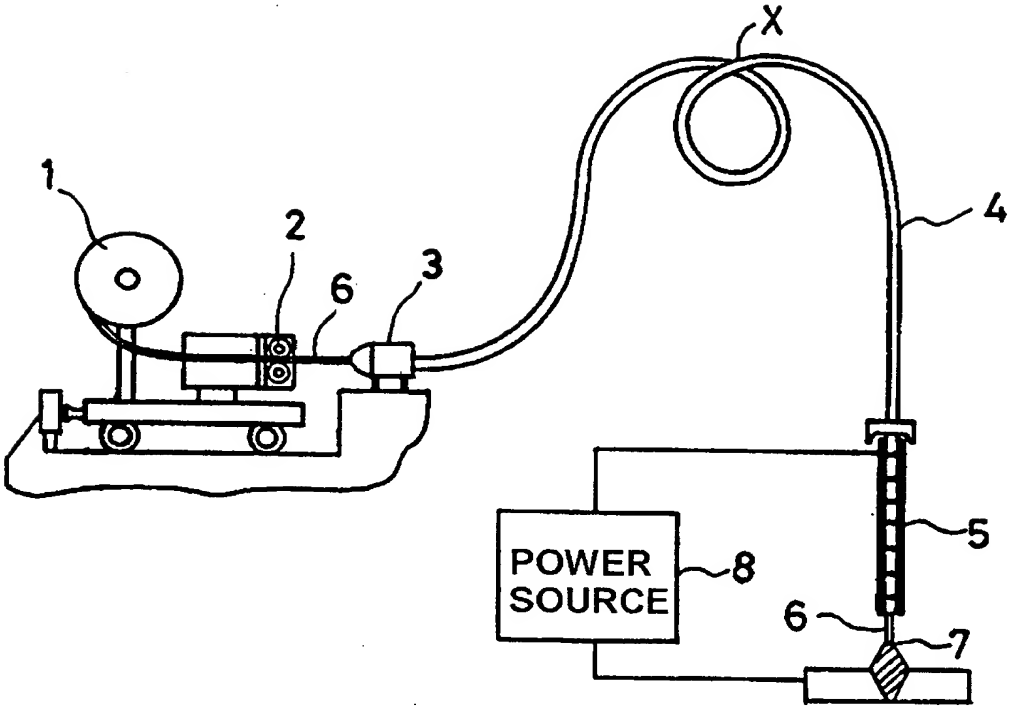


Fig. 1B

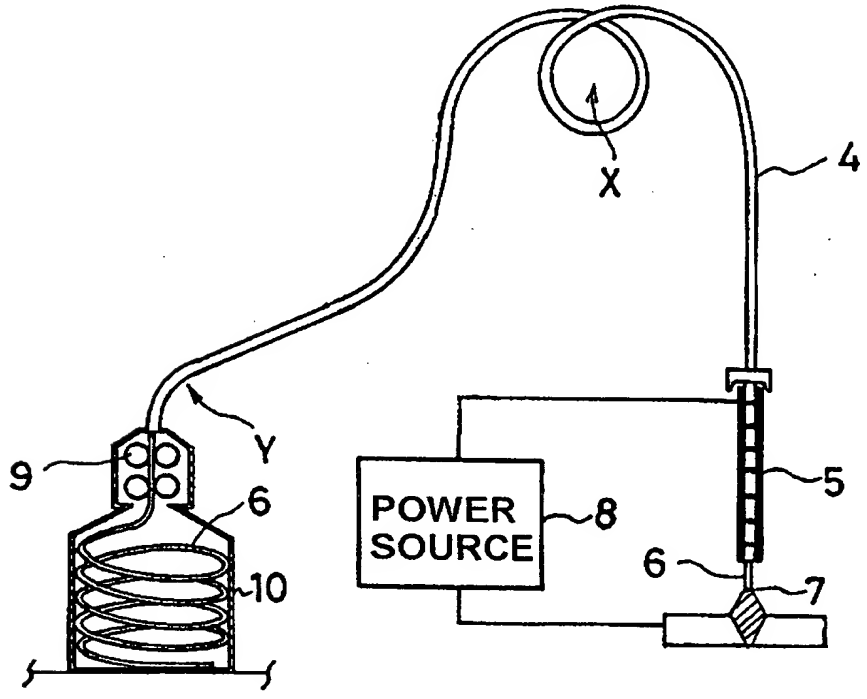


Fig. 2

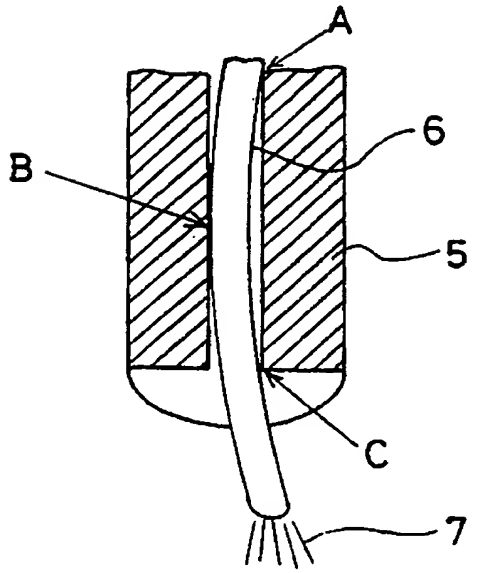


Fig. 4

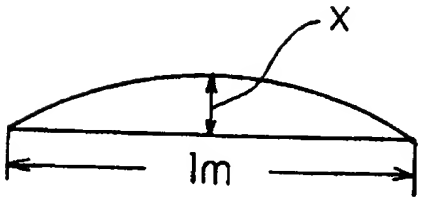


Fig. 3

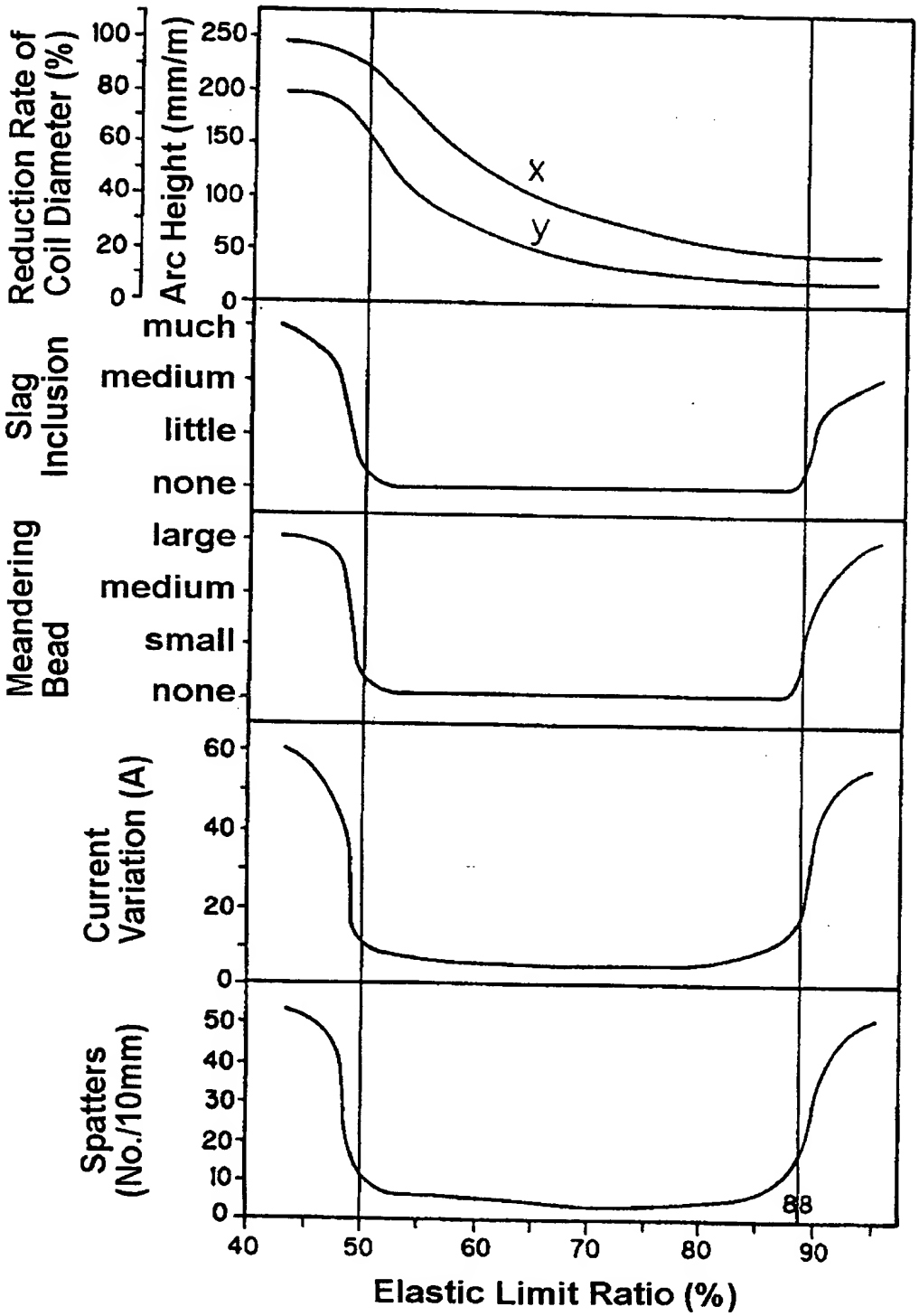

Reduction Rate of Coil Diameter (%)
Arc Height (mm/m)
100
80
60
40
20
0
250
200
150
100
50
0
x
y
Slag Inclusion
much
medium
little
none
Meandering Bead
large
medium
small
none
Current Variation (A)
60
40
20
0
Spatters (No./10mm)
50
40
30
20
10
0
88
40
50
60
70
80
90
Elastic Limit Ratio (%)

Fig. 5

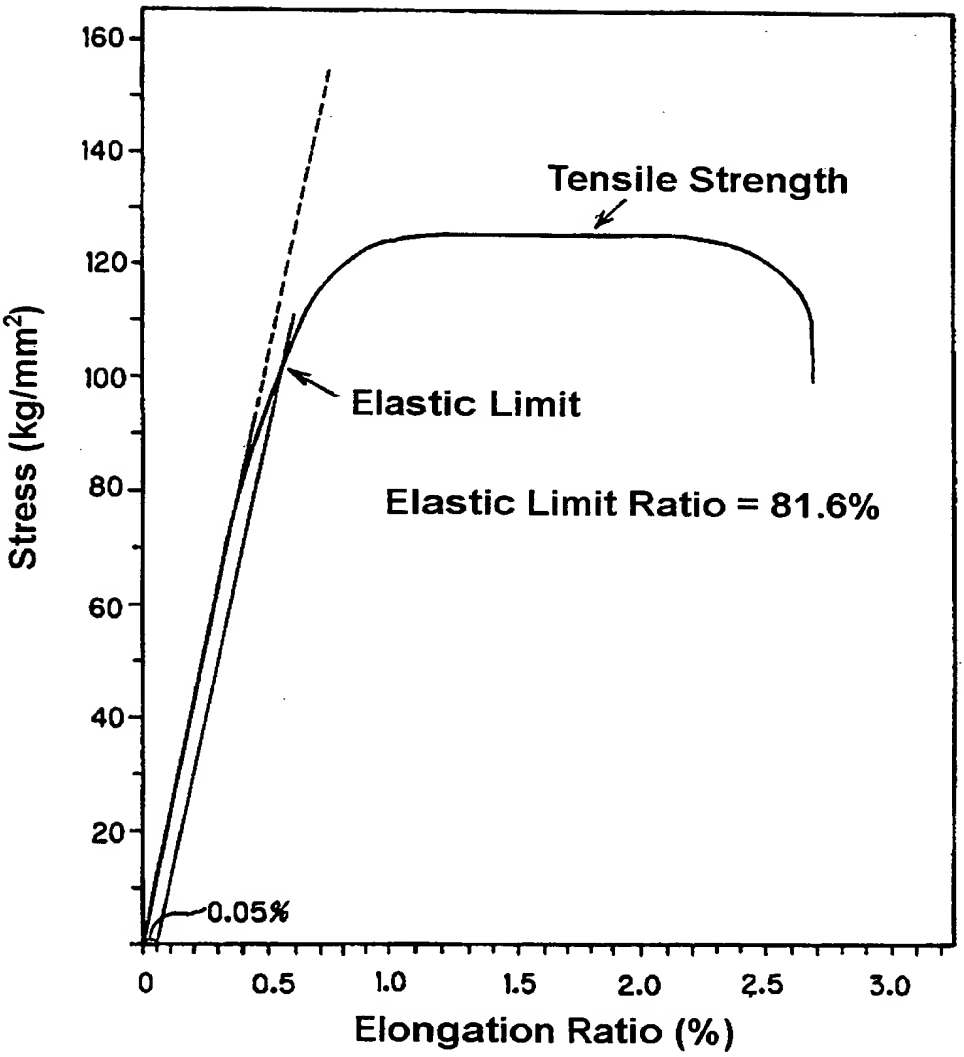

160
140
120
100
80
60
40
20
Stress (kg/mm²)
Tensile Strength
Elastic Limit
Elastic Limit Ratio = 81.6%
0.05%
0
0.5
1.0
1.5
2.0
2.5
3.0
Elongation Ratio (%)

Fig. 6

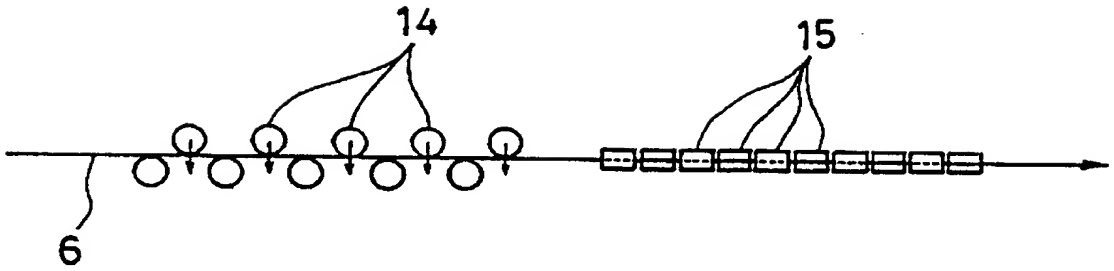
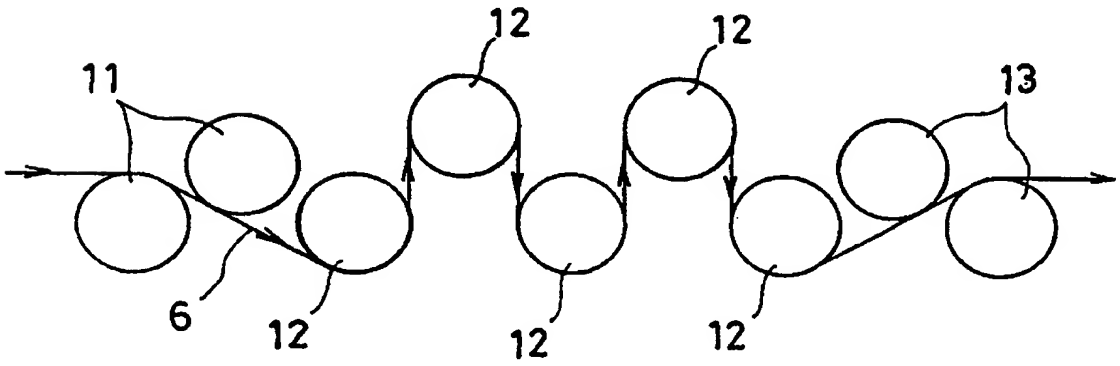


Fig. 7



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR 00/00151

A. CLASSIFICATION OF SUBJECT MATTER

IPC[7]: B 23 K 9/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC[7]: B 23 K 9/12, 9/24, 9/26

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3799215 A (WILLEMS) 26 March 1974 (26.03.74), fig. 1,2.	1,2
A	AT 167656 B (ELIN) 15 July 1950 (15.07.50), fig..	1,2

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
„A" document defining the general state of the art which is not considered to be of particular relevance
„E" earlier application or patent but published on or after the international filing date
„L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
„O" document referring to an oral disclosure, use, exhibition or other means
„P" document published prior to the international filing date but later than the priority date claimed
„T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
„X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
„Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
„&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
02 May 2000 (02.05.00)	19 July 2000 (19.07.00)
Name and mailing adress of the ISA/AT Austrian Patent Office Kohlmarkt 8-10; A-1014 Vienna Facsimile No. 1/53424/200	Authorized officer Bencze Telephone No. 1/53424/373

Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/KR 00/00151

Patent document cited in search report			Publication date	Patent family member(s)			Publication date
US	A	3799215	26-03-1974	AU	A1	48875/72	16-05-1974
				BE	A1	791587	17-05-1973
				CH	A	541381	31-10-1973
				DE	A1	2253291	24-05-1973
				FR	A1	2160532	29-06-1973
				FR	B1	2160532	29-10-1976
				GB	A	1410049	15-10-1975
				IT	A	974832	10-07-1974
				JP	A2	48062637	01-09-1973
				NL	A	7115945	22-05-1973
				SE	B	394861	18-07-1977
				SE	C	394861	27-10-1977
AT	E	167656	15-07-1998	AU	A1	32113/93	19-08-1993
				AU	B2	653884	13-10-1994
				CA	AA	2087580	26-08-1993
				CA	C	2087580	18-11-1997
				DE	C0	69319263	30-07-1998
				DE	T2	69319263	04-03-1999
				EP	A1	557922	01-09-1993
				EP	B1	557922	24-06-1998
				ES	T3	2117677	16-08-1998
				MX	A1	9300832	01-09-1993
				US	A	5156742	20-10-1992

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PATENT COOPERATION TREATY

PCT

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
99744/KWE		
International application No.	International filing date (*day/month/year*)	Priority Date (*day/month/year*)
PCT/KR 00/00151	24 February 2000 (24.02.2000)	25 February 1999 (25.02.1999)

International Patent Classification (IPC) or national classification and IPC

IPC[7]: B23K 9/12

Applicant

Kiswel Ltd. et al.

1. This international preliminary examination report has been prepared by this International Preliminary Examination Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 3 sheets, including this cover sheet.

☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of _____ sheets.

3. This report contains indications relating to the following items:

- I. ☒ Basis of the opinion
- II. ☐ Priority
- III. ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV. ☐ Lack of unity of invention
- V. ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI. ☐ Certain documents cited
- VII. ☐ Certain defects in the international application
- VIII. ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
18 September 2000 (18.09.2000)	4 May 2001 (04.05.2001)
Name and mailing address of the IPEA/AT Austrian Patent Office Kohlmarkt 8-10 A-1014 Vienna Facsimile No. 1/53424/200	Authorized officer Telephone No. 1/53424/373

Form PCT/IPEA/409 (cover sheet) (July 1998)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/KR 00/00151

I. Basis of the report

1. With regard to the **elements** of the international application:*

☒ the international application as originally filed

☐ the description:
pages _____ , as originally filed
pages _____ , filed with the demand
pages _____, filed with the letter of _____.

☐ the claims:
pages _____ , as originally filed
pages _____ , as amended (together with any statement) under Article 19
pages _____ , filed with the demand
pages _____, filed with the letter of _____.

☐ the drawings:
pages _____ , as originally filed
pages _____ , filed with the demand
pages _____ , filed with the letter of _____.

☐ the sequence listing part of the description:
pages _____ , as originally filed
pages _____ , filed with the demand
pages _____ , filed with the letter of _____.

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language _____ which is:

☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).

☐ the language of publication of the international application (under Rule 48.3(b)).

☐ the language of the translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/ or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

☐ contained in the international application in printed form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages _____.

☐ the claims, Nos. _____.

☐ the drawings, sheets/fig _____.

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

** Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as „originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).*

*** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.*

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/KR 00/00151

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1,2	YES
	Claims		NO
Inventive step (IS)	Claims	1,2	YES
	Claims		NO
Industrial applicability (IA)	Claims	1,2	YES
	Claims		NO

Citations and explanations (Rule 70.7)

The application relates to an arc welding solid wire whose surface comprises copper plated film, wherein the elastc limit ratio (elastic limit/tensile strength) of the wire finally produced is controlled in the range between 50 and 88% and wherein said elastic limit ratio is controlled by installing three to eight elastic limit ratio control vertical rollers and three to eight elastic limit ratio control transverse rollers which have a ratio D/d equal to 40 to 60 (where D is roller diameter and d is wire diameter) following coil control vertical and transverse rollers after final drawing.

Documents US 3799215 A and AT 167656 B disclose devices for driving and straightening welding wires.None of these documents teach the special welding wire and the special controlling device.
Therefore the features of claims 1 and 2 can be considered to be novel and involving an inventive step.
Industrial applicability is given, as well.